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UNITED STATES PATENT APPLICATION

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Invention: STRUCTURAL COMPONENTS FORMED USING A SYSTEM FOR
 RECYCLING WET CONCRETE AND USES THEREOF

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5 STRUCTURAL COMPONENTS FORMED USING A SYSTEM FOR
 RECYCLING WET CONCRETE AND USES THEREOF

10 CROSS-REFERENCE TO RELATED APPLICATIONS

 This application is related to U.S. Provisional Application Serial Number 60/535,450,
 filed 8 January 2004, entitled "System for recycling wet concrete into precast structures and
 structures formed thereby."

15 BACKGROUND OF THE INVENTION

1. Field of the Invention.

 The present invention relates to efficiently recycling concrete waste from ready-mix
 cement trucks. More particularly, the present invention relates to a system for recycling
 excess wet concrete, the structural components formed thereby, and the myriad of beneficial
20 uses that exist for those components.

2. Discussion of the Background.

 Often times ready-mix concrete trucks return to the cement yard at the end of the work
 day with relatively large amounts of excess fresh concrete. This excess fresh concrete must
25 be disposed of or recycled in some manner, so that the cement trucks may be cleaned for the
 next day's operations.

 The typical disposal process has long involved wetting down the concrete within the
 mixing truck itself to significantly dilute it, and then dumping the wet concrete. This wet
 concrete is then held in a bin for approximately five days, during which time the particulate
30 separates from the water. After separation of the excess water, the solid material is moved to

5 a drying bin and after some period it is transported to a landfill. This disposal process results
in a significant waste of refuse solid material, and a large added cost of transportation and
disposal of the refuse solid material. Moreover, cities are now beginning to wrestle with the
problem of storing refuse solid material inasmuch as vast piles of it are collecting at many
landfills. As a result, a number of processes have been attempted to recycle the residual
10 concrete, albeit all have generally been directed towards recovery of the concrete aggregate
(i.e. landfill material).

One method, well-known in the industry, for recycling excess fresh concrete includes
having the mixing truck operators dump the excess concrete into on-site molds. Once the
concrete hardens it is removed from the mold and fed into a breaking, or crushing device.
15 The concrete is broken or ground into small pieces which are sold to construction sites for
use as base fill for foundation, sub-foundation, or roadbed projects.

Other examples of recycling excess concrete are found in U.S. Patent Nos. 5,908,265 to
Mostkoff (disclosing a method and apparatus for producing concrete shapes suitable for use
in forming an artificial reef using ready mix cement trucks with excess load to blend
20 measured amounts of concrete and tire chips), 5,766,524 to Rashwan et al. (disclosing a
method and apparatus for the reclamation of excess concrete returned to the cement yard by
cement delivery trucks using molds designed to produce blocks of concrete suitable for
regrinding into aggregate), and 3,786,997 to Viner (disclosing a wet concrete reclamation
method and apparatus in which unused concrete is poured and formed, and then crushed into
25 little pieces).

Additionally, the use of molds to form concrete into various component shapes is also
well-known in the industry. For example, U.S. Patent No. 5,096,648 to Johnson et al.

5 discloses a mold system for producing paving stones that employs a plurality of slidably
mounted molds, and U.S. Patent No. 4,067,941 to Gaudelli et al. discloses a mold for
producing multiple slabs of concrete. However, the conventional techniques for molding
concrete into pre-cast components such as paving stones or simple slabs are not suitable for
the contemplated uses of the components molded from the recycled material of the present
10 invention for the following reasons. Historically, the process of removing the hardened
concrete components from molds is a time consuming and expensive because great care must
be taken to ensure that the molded component is not damaged. Moreover, the resulting pre-
cast components are not strong enough to be used as ground, shoring or stack wall planks
because they are not reinforced. Finally, the resulting components are not easily manipulated
15 and stacked because they are not made with integral or attachable lifting handles.

Therefore, there remains a need in the art for an efficient and cost effective system for
recycling excess wet concrete from ready-mix concrete trucks into components that possess a
variety of beneficial uses. To the best of the knowledge of the present inventor, no prior art
system addresses this need. A system of this type should provide for the pouring of residual
20 wet concrete into molds to make pre-cast components such as ground planks, shoring planks,
stack wall planks, and the like. Once the concrete has set, the resulting components should
be easy to remove from the mold and stackable so that they may be stored or displayed for
sale. Steel reinforcing materials, lifting handles, and/or elements that assist in the assembly
of two or more components should be included to make the concrete components stronger
25 and easier to manipulate and configure.

Furthermore, the pre-cast concrete components should be configured such that they may
be used in the construction of a wide variety of beneficial structures. The structures

5 assembled from two or more of the concrete components should be inexpensive, easily
constructed, and permanent or temporary in nature.

SUMMARY OF THE INVENTION

10 The primary object of the present invention is to provide components formed by an
efficient and cost-effective system that recycles wet concrete waste material from ready-mix
cement trucks into “residual-collection” molds.

It is another object of the present invention to provide components formed from recycled
wet concrete that are easily removed from the molds.

15 Yet another object of the present invention is to provide components formed from
recycled wet concrete that are ready-to-use and structurally sound.

It is another object of the present invention to provide components formed from recycled
wet concrete such as ground planks, shoring planks, stack wall planks, and the like.

20 An additional object of the present invention is to provide components formed from
recycled wet concrete that include integral or attachable lifting handles or rings for easy
handling on a work site.

Still another object of the present invention is to provide components formed from
recycled wet concrete that include reinforcing materials to increase structural strength.

Another object of the present invention is to provide components formed from recycled
wet concrete that include elements that assist in assembling two or more components.

25 It is another object of the present invention to provide components formed from recycled
wet concrete that are stackable so that they may be readily stored or displayed for sale.

5 Yet another object of the present invention is to provide components formed from recycled wet concrete that are inexpensive to manufacture and sell.

It is still another object of the present invention to provide structures comprising one or more of the recycled concrete components that have a myriad of beneficial uses.

An additional object of the present invention is to provide structures comprising one or
10 more of the recycled concrete components that are inexpensive and easily constructed.

Still another object of the present invention is to provide structures comprising one or more of the recycled concrete components that are permanent or temporary in nature.

The present invention addresses these and other objects by providing a system that begins with concrete mixing trucks returning to the cement plant throughout the workday.

15 “Residual-collection” molds, kept on-hand at the plant, are filled with any excess wet concrete present in the returning trucks. The molds are configured to form pre-cast components such as ground planks, shoring planks, stack wall planks, and the like.

Once the concrete has set, the resulting components are strong, yet easy to remove from the molds and manipulate (e.g. stack), due to the presence of integral reinforcing materials
20 and integral or attachable lifting handles. In that way, they may be stored or displayed for sale. Also integral to the finished components are elements that assist in the assembly of two or more components. The finished components are low in cost due to the use of recycled wet concrete, inexpensive reinforcing materials (e.g. “rebar”), and handles/assembly elements fabricated from other recycled materials (e.g. PVC). The finished components may be sold
25 or leased to customers. This converts the incremental costs typically associated with traditional residual concrete disposal techniques into supplemental income streams based upon the present invention’s novel use of recycled wet concrete.

5 The lifting handle/ring may be either a length of bent rebar that is an element of the
integral reinforcing materials, or a pre-engineered, integral or attachable, PVC or plastic
handle, capable of supporting 300% of the pre-cast component's weight. When an integral
handle is present, bolt cutters may be used to remove the handle as necessary once the
component is in place at a work site. In another embodiment, the handle may be attached to
10 the component via a hinge such that it lies flat against a surface of the component when not
in use. In yet another embodiment, a cylindrical section of PVC may be used to form a pre-
cast hole in the structure. Once the concrete has set, the PVC sleeve may be removed and a
swage bolt may be inserted for use as a handle.

 The system of the present invention also provides components with integral patterns,
15 textures, and/or colors. Specifically, wet concrete is poured into the mold, and then screeded
and floated to create a surface that is smooth and suitable for finishing with a pattern, texture,
and/or color. The concrete may then be embossed with a desired pattern or texture via the
use of a heavy roller that is rolled over the top of the mold. The roller is grooved on its outer
edges, and at pre-determined intervals, to provide for proper guidance over the mold and/or
20 to ensure that the pattern is appropriately aligned and embossed to a constant depth. Colors
and/or other textures may be added by conventional methods such as the application of a thin
layer of exposed aggregate or brick dust.

 Once complete, the pre-cast concrete components may be assembled into a wide variety
of useful structures. For example, the ground planks of the present invention may be used in
25 place of, or as a supplement to, sub-grade/fill materials particularly in heavy/high traffic
areas, as temporary covers for excavations necessitated by road construction/repair, and in
the construction of sidewalks, remote/private road surfaces, or irrigation ditches. Shoring

5 planks, for example, may be used in conjunction with soldier piles in trenches for
utilities/infrastructure repair or installation, and excavations associated with construction
projects. Stack wall planks, for example, may be used in the construction of all types of
walls, temporary salt domes, and mid- to large-size planters. Moreover, a variety of urban
renewal and temporary land reclamation projects involving structures such as basketball
10 courts, golf driving ranges, or community parks may be constructed using a combination
ground and stack wall planks.

A common element is that all structures assembled from two or more of the concrete
components are inexpensive due to the low cost of the individual components, easily
constructed, and may be permanent or temporary in nature.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top perspective view of a casting bed 15 including a plurality of molds 18 (or
“forms”) used to create ground planks according to a preferred embodiment of the present
invention.

20 FIG. 2 is a cross-sectional side view of a ground plank 20 illustrating the reinforcing
material 21 and an integral bent rebar-type lifting handle 30.

FIG. 3 is a cross-sectional side view of a ground plank 20 illustrating an alternative
integral pre-engineered PVC-type lifting handle 32. The reinforcing material 21 of FIG. 2 is
not shown.

25 FIG. 4 is a cross-sectional side view of a ground plank 20 illustrating an alternative
attachable swage bolt-type lifting handle 34. The reinforcing material 21 of FIG. 2 is not
shown.

5 FIG. 5 is a cross-sectional front view of a ground plank 20 illustrating a hinged lifting handle 36. The reinforcing material 21 of FIG. 2 is not shown.

FIG. 6 is a cross-sectional side view, taken along A-A, of the ground plank 20 of FIG. 5. The reinforcing material 21 of FIG. 2 is not shown.

10 FIG. 7 is a top perspective view of a ground plank 20 illustrating the use of a roller 41 to emboss a pattern or texture 40 on the surface of the plank 20.

FIG. 8 is a cross-sectional side view of a loading dock/zone 100 showing the use of the ground plank 20 of FIG. 2 or 3.

FIG. 9 is a cross-sectional view of an irrigation ditch 140 showing the use of the ground plank 20 of FIG. 2 or 3.

15 FIG. 10 is a cross-sectional view of a road surface 180 showing the use of the ground plank 20 of FIG. 2 or 3 as installed in a shallow excavation 182.

FIG. 11 is a top perspective view of a shoring plank 60 according to an alternative embodiment of the present invention and its use in conjunction with two soldier piles 70.

20 FIG. 12 is a front perspective view of the shoring planks 60 and soldier piles 70 of FIG. 11.

FIG. 13 is a front perspective view of a plurality of stack wall planks 80 according to an alternative embodiment of the present invention and their use in the construction of a stack wall 220.

DETAILED DESCRIPTION

5 The present invention is a series of pre-cast structural components fabricated of the recycled excess or residual wet concrete remaining in ready-mix concrete trucks after completion of a job, and a variety of beneficial uses for those components.

10 The recycling of the excess or residual wet concrete begins with the mixing trucks returning to the plant during and at the end of the workday. "Residual-collection" molds are kept on-hand at the plant, and as the ready-mix cement return they evacuate their excess wet concrete into the residual-collection molds. The molds are configured to form pre-cast structural components such as ground planks, shoring planks, stack wall planks, and the like.

15 FIG. 1 is a plan view of a casting bed 15 sectioned to include a plurality of molds 18 for creating ground planks from recycled concrete, according to a preferred embodiment of the present invention.

20 As stated above, at the end of a workday it is common for returning trucks to be carrying more than a quarter cubic yard of excess wet concrete. To recycle this wet concrete, portable or stationary "residual-collection" molds 18 are kept on-hand at the plant, and as the ready-mix cement trucks return they evacuate their excess wet concrete into the residual-collection molds 18. Over the course of days or weeks the molds 18 are filled to create a plurality of completed, precast concrete planks as will be described. Upon completion, the planks are removed and inventoried, and the process begins anew. In the meantime, the completed planks are sold or leased to customers. This not only avoids the incremental cost associated with the traditional disposal of concrete aggregate, but also produces a supplemental income stream from it.

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5 The “residual-collection” molds 18 of the present invention include a casting bed 15 for molding concrete into planks. FIG. 1 is a top perspective view of a casting bed 15 including a plurality of molds 18 (or “forms”) used to create ground planks according to a preferred embodiment of the present invention. The casting bed 15 is comprised of rectangular steel plate flooring 14, four steel plate perimeter walls 16, a plurality of lengthwise steel plate
10 dividers 17, and one or more widthwise steel plate dividers 13.

 The perimeter walls 16 and the dividers 17, 13 are preferably formed in the shape of narrow-angle triangles, apex pointed upward, in which the symmetrical sides are comprised of strips of steel plate, stitch welded together along the apex. These angular perimeter walls 16 and dividers 17, 13 are necessary to ensure that the cast form is easily removed from the
15 mold 18 once set. The bottom of the perimeter walls 17, 13 may be tack welded along the steel plate flooring 14 to form an enclosed and sectioned rectangular form.

 In one particular embodiment of the casting, a full-length mold 18 is configured to produce 12” wide x 12’ long x 6” thick ground planks. A ground plank 20 of this size requires approximately a quarter cubic yard of concrete and is, relatively speaking, small and
20 light enough to be easily manipulated (i.e. stacked, displayed for sale). Widthwise steel plate dividers 13 are employed to create alternative smaller molds 19 to create planks 20 that are, for example, half the length (i.e. 6 feet) of those created by the full-length mold 18. Those skilled in the art will appreciate that planks 20 of other lengths may be fabricated in this manner without diverting from the spirit of the present invention.

25 FIGs. 2-6 are cross sectional views of ground planks 20 formed in accordance with the above-described recycling method using the casting bed 15 of FIG. 1. The ground planks 20 preferably are equipped with one or more lifting handles 30, 32, 34, 36, and integral

5 reinforcement, such as commercially available welded wire mesh or steel rebar, as will be described.

FIG. 2 shows a plank 20 incorporating a pre-formed reinforcing cage 21. The reinforcing cage 21 may be constructed from two layers of conventional welded wire mesh 26 with each layer supported by a pair of commercially available 2" continuous slab bolsters 27. Those skilled in the art will appreciate that other forms of concrete reinforcement (e.g. steel rebar) may also be suitable for the purpose of reinforcing the planks 20 of the present invention. The reinforcing cage 21 is introduced into the casting bed 15 prior to recycling of the concrete, such that poured concrete will submerge the reinforcing cage 21 and harden around it.

15 Additionally, in order for the planks 20 to be easily removed from the molds 18 (FIG. 1) and manipulated, the planks 20 are preferably formed with one or more fixedly (i.e. integral) or removably attached lifting handles. For safety reasons, the lifting handles should be rated to hold up to 300% of the plank's weight. As seen in FIG. 2, a bent rebar lifting handle 30 is wired or otherwise attached to the pre-formed reinforcing cage 21 and thereby becomes an integral part of the plank 20.

FIG. 3 is a cross-sectional side view of a ground plank 20 illustrating an alternative integral pre-engineered PVC-type lifting handle 32. In both cases the lifting handles 30, 32 should extend approximately four inches above the surface of the plank 20 to allow a standard hook connected to a piece of lifting equipment (e.g. a front-end loader with a boom) may be used to lift and move the plank. If necessary for structural or aesthetic reasons, the lifting handles 30, 32 may be easily removed by bolt cutters once the plank 20 is in properly positioned. The lifting handles 30, 32 are introduced into the casting bed 15 during the

5 recycling process after the concrete has attained a desired height within the mold 18, such that subsequently-poured concrete will harden around the ends of the lifting handles 30, 32 and anchor them in the plank 20.

In another embodiment of the ground plank 20 of the present invention, as shown in FIG. 4, the lifting handle 34 is removably attached to the plank 20. A hole 35 for use with an
10 attachable handle 34 is created by placing a plugged PVC sleeve 33 into wet concrete present in a mold 18 (FIG. 1) at the desired handle location. Once the concrete has set, the sleeve 33 may be removed and a commercially available swage bolt 34 may be inserted/attached for use as a handle. This is the preferred type of handle for planks 20 with surface finishes such as textures, patterns, and/or colors (see discussion below) because, once the plank 20 is
15 properly positioned, the handle 34 may be removed and the pre-cast hole 35 may be filled in and camouflaged.

In yet another embodiment of the ground plank 20 of the present invention, that shown in FIGs. 5 and 6, a lifting handle 36 comprising a hinge 37 may be either integrally attached as with the rebar handle 30 of FIG. 2 or the pre-engineered PVC 32 handle of FIG. 3, or
20 removably attached as with the swage bolt handle 34 of FIG. 4. The hinge 37 is positioned at the surface of the plank 20. Additionally, a piece of material approximating the size and shape of the lifting handle 36 is placed proximate the hinge 37, on the surface of the wet concrete held within the mold 18 (FIG. 1), to create a void 38 in the surface of the plank 20. This void 38 permits the lifting handle 36 to pivot at its hinge 37 and lie flush with the
25 smooth surface of the plank 20. This type of handle 36 is ideally suited for ground planks 20 used as temporary road surfaces, where easy and efficient transfer of the planks 20 from one location to another is typically required.

5 The recycling method and planks 20 formed thereby according to the present invention can be post-cured with integral colors, textures and/or patterns. After the surface of the recycled concrete is made smooth and suitable for taking a finish by traditional means (i.e. screeding, floating), colors and/or textures may be added by conventional methods such as applying exposed aggregate or brick dust, or by simply running a broom over the wet
10 concrete. As shown in FIG. 7, selected patterns or textures 40 (i.e. layered brick-like pattern) may be also be embossed in the surface of a plank 20 by a heavy roller 41 formed with the pattern 40 on its exterior surface. The roller 41 of a predetermined length is rolled over the top surface of the recycled concrete held in a mold 18 (FIG. 1) to emboss the pattern. The roller 41 includes grooves 42 on its outer edges, and, when necessary, at predetermined
15 intervals, to guide it along the walls of the mold 18 to ensure that the pattern is aligned and embossed to a constant depth.

The casting bed 15 of FIG. 1, as indicated above, may be configured to produce planks with different dimensions. For example, planks may be formed that are 24" wide x 12' long x 6" thick (approximately a half cubic yard of wet concrete) or 36" wide x 24' long x 8"
20 thick (approximately 1.75 cubic yards of wet concrete). The ground planks 20 of FIGs. 1-7 have many beneficial uses limited only by their non-specified compressive strength and a user's imagination.

For example, ground planks 20 may be used in place of, or as a supplement to, sub-grade or fill materials in heavy/high traffic areas. Areas subject to heavy traffic, in terms of weight
25 and frequency of use, include construction site entrances/exits and loading docks/zones 100 as shown in FIG. 8's cross-sectional view. Use of the planks 20 in a loading dock/zone 100 may be as a supplement to some form of gravel 102, wherein the planks 20 are positioned

5 beneath the gravel 102 to prevent its dispersal or ingress into the underlying ground 104,
creating the need to replace it. Any standard asphalt paving material 106 may be applied to
create the finished road surface 108. Alternatively (not shown in the Figures, the planks 20
may be used to replace traditional sub-grade/fill materials and provide a more stable platform
on which the typical asphalt paving material may be applied directly. These configurations
10 reduce the frequency of re-paving operations.

High traffic zones (i.e. high frequency of use/travel, but relatively lightweight vehicles)
where the ground planks 20 of the present invention may be applied beneficially include the
shed/barn entrances found on farms, which often seem to be perpetually wet and subject to
significant rutting. When deployed in these zones, the planks 20 may be set directly upon
15 undisturbed ground, or situated in a shallow excavation that places the top surface of each
plank 20 roughly flush with the surface of the surrounding ground.

The ground planks 20 may also be used, in place of the traditional steel plates, as
temporary covers for excavations necessitated by road construction/repair or the trenches that
accompany the installation of underground utilities or infrastructure. When used in this
20 manner, it is preferable that the planks be recessed into the road surface such that the top
surface of each plank is flush with the surrounding road surface. The ground plank 20
embodiment of FIGs. 5 and 6 are particularly beneficial to this type of application due to the
existence of hinged handles that sit flush to the surface of the plank 20 when not being used.

The planks 20 may be installed as temporary bridges over narrow ditches (e.g. irrigation
25 ditches) and waterways while permanent solutions are constructed. As shown in FIG. 9's
cross-sectional view, the ground planks 20 may even be used to line an irrigation ditch 140

5 such that the erosion of the underlying soil 142 by the flow of water 144 is minimized and/or eliminated.

Yet another use of the ground planks 20 of the present invention, as shown in FIG. 10's cross-sectional view, may be in the construction of road surfaces 180 that are temporary, or permanent rural (i.e. remote) or private road surfaces, such as driveways or farm roads, that are not subject to significant use. Their use in this type of application may be as a replacement for, or as a supplement to, some form of gravel. As discussed above with respect to FIG. 8, when used as a supplement to gravel, the planks 20 are positioned beneath the gravel to prevent its dispersal or ingress into the underlying ground. When used without accompanying gravel, as shown in FIG. 10, the planks 20 may be situated in a shallow excavation 182 that places the top surface of each plank 20 roughly flush with the surface of the surrounding ground 184. Alternatively, the planks 20 may be set directly upon undisturbed ground. The road surface 180 may be constructed by positioning the planks perpendicular (as in FIG. 10) or parallel to the direction of travel on the road.

Finally, the ground planks 20 may be used in the construction of sidewalks/walkways. Once again, planks 20 used in this manner may be placed directly upon undisturbed ground, or situated in a shallow excavation that places the top surface of each plank 20 roughly flush with the surface of the surrounding ground. The ground plank 20 embodiments of FIGs. 4 and 7 are particularly beneficial to this type of application due to the ability to hide/camouflage the means for handling/moving the plank 20 and the existence of a surface pattern, texture, and/or color that enhances their aesthetic qualities.

In each of the above-described applications, the compressive strength of the set, recycled concrete forming the finished ground planks 20 is indeterminate, and inconsequential. The

5 ground planks 20 of the present invention are not intended for applications requiring well-defined compressive strength parameters such as those with extremely high stress/load requirements (e.g. interstate highways, building foundations, bridge piers). Such planks 20 are ideal for driveway surfaces, sidewalks, garden retaining walls, and the like because they are aesthetically pleasing and require less labor to install than traditional pavers or stones.

10 Alternative embodiments of the pre-cast planks of the present invention include shoring planks 60 with notches formed at their ends (for interaction with soldier piles 70 as discussed below with respect to FIGs. 11 and 12) and stack wall planks 80 with through holes proximate their ends (for alignment and assembly purposes as discussed below with respect to FIG. 13).

15 The shoring planks 60 of the present invention may be used in the construction of the trenches typically required by the installation or repair of underground utilities/infrastructure, or during the excavation of a building's foundation. A plurality of planks 60 are typically used in conjunction with a plurality of soldier piles 70 to construct a shoring wall 75 such as that shown in FIGs. 11 and 12. Commercially available soldier piles 70, comprising a
20 substantially I-shaped cross-section, are driven vertically into the ground 78 at distance intervals approximately equal to the length of a plank 60. Notches 62 are preferably formed at each end of the planks 60 and are designed to interact with the soldier piles 70 such that each plank 60 may be supported in a vertical orientation between two piles 70.

Multiple planks 60 may be stacked vertically depending upon the depth of the trench or
25 excavation. Gaps 72, to allow for water drainage, are formed in the shoring wall 75 by positioning spacers 74 in the recesses of the soldier piles 70 between each pair of planks 60. The spacers 74 are preferably short sections of a commercially available plastic rod material

5 (e.g. recycled PVC) possessing sufficient compressive strength to support the weight of several planks 60 stacked vertically. Soil ingress into the trench/excavation is prevented by spanning the gaps 72 with a commercially available, porous material (e.g. filter cloth) that allows water, but not dirt/soil, to pass through.

10 By providing for water drainage from behind the shoring wall 75 through the gaps 72, the horizontally oriented forces exerted on the wall 75 by the ground 78 are reduced to the point where the indeterminate compressive strength of the set, recycled concrete forming the finished planks 60 is inconsequential. The shoring planks 60 of the present invention are, just like the ground planks 20 described above, not intended for applications requiring well-defined compressive strength parameters.

15 The stack wall planks 80 of the present invention may be used to construct stack walls 220, such as that shown in FIG. 13, of varying (i.e. user-defined) lengths and heights. This may be accomplished by forming each plank 80 with a hole 82, running through the plank's thickness, proximate each end. In constructing a stack wall 220, each layer of planks 80 is offset from the layer immediately below with the holes 82 aligned vertically. Vertical
20 alignment of the holes 82 allows a rod 84 to be inserted through the multiple layers of planks 80 to increase the structural integrity of the wall 220 with respect to horizontally applied forces. Each rod 84 is preferably a length of commercially available metal such as round rebar.

25 Stack walls 220 may, for example, be used to construct the temporary salt domes (with roofs formed by sheet of water-resistant, recycled plastic) required only in years where an excessive amount of winter weather is expected (i.e. necessitating the stockpiling of an amount of salt/chemicals greater than the storage capacity of all permanent salt domes), or

5 mid- to large-size planters using sections of filter cloth to retain the enclosed soil. The gaps
90 formed by the offsetting of the planks 80 of each layer serve to minimize any horizontally
oriented forces that may be exerted on the wall 220 such that the indeterminate compressive
strength of the set, recycled concrete forming the finished planks 80 is inconsequential. Just
as with the ground planks 20 and shoring planks 60 described above, the stack wall planks 80
10 of the present invention are not intended for applications requiring well-defined compressive
strength parameters.

Those skilled in the art will appreciate that ground planks 20, shoring planks 60, and
stack wall planks 80 may be combined to create any one of a virtually unlimited number of
different structures without diverting from the spirit of the present invention. For example,
15 an alternative form for a ground plank fabricated from recycled concrete is that of the
parking curbs used in parking lots/garages to separate one parking spot from the next.
The planks 20, 60, 80 may be combined to form larger structures, including, but not limited
to, basketball courts, golf driving ranges, manholes and manhole covers, and community
parks, may be permanent or temporary in nature and may be used in a variety of urban
20 renewal and/or temporary land reclamation projects.

A basketball court may be constructed, once the backboard supports have been anchored,
using ground planks 20 to form the court surface, stack wall planks 80 in the assembly of a
stack wall surrounding the court, and a combination of ground and stack wall planks 20, 80
to create a variety of seating surfaces (e.g. benches, stands/bleachers) for the players and
25 spectators. A golf driving range may be constructed using ground planks 20, underlying a
series of appropriately spaced artificial grass mats, to form the hitting surfaces, stack wall
planks 80 or shoring planks 60 combined with soldier piles, in the assembly of barriers

5 between each hitting surface (i.e. artificial grass mat), and a combination of ground and stack wall planks 20, 80 to create a variety of seating surfaces for the participants and/or observers.

 Square manholes may be constructed using shoring planks 60 (with gaps in between as above in FIG. 12) combined with soldier piles to form the vertical walls, with the manhole covers being formed from ground planks 20, possibly formed as a square (e.g. 48"x48"x6" thick), instead of a rectangle, and equipped with a hinged handle that, when not in use, fits within a recess formed in the surface of the plank (see FIGs. 5 and 6). The cover may be connected to the manhole via a hinge that is preferably fabricated of recycled PVC. Finally, a community park, or an area of common ground, may be constructed using ground planks 20 to form walkways and courtyards/plazas, stack wall planks 80 or shoring planks 60 combined with soldier piles, in the assembly of barriers around or within the park, and a combination of ground and stack wall planks 20, 80 to create a variety of seating surfaces for visitors.

 All of the structures assembled from two or more of the recycled concrete planks 20, 60, 80 are inexpensive due to the minimal cost of the individual components, easily constructed due to the various means of assembly, and permanent or temporary in nature depending upon the needs of the application.

 Having now fully set forth the preferred embodiments and certain modifications of the concept underlying the present invention, various other embodiments as well as certain variations and modifications of the embodiments herein shown and described will obviously occur to those skilled in the art upon becoming familiar with said underlying concept. It is to be understood, therefore, that the invention may be practiced otherwise than as specifically set forth in the appended claims.